SCIENCE & EDUCATION
Impact
Benefits from USDA/Land-Grant Partnership

Tapping Genetic Tools

Biotechnology shows promise for health, environment, economy.

Some say biotechnology and genetic advancements will be an economic engine for the coming century and hold great promise for human health and food production. USDA and land-grant university scientists are using the tools of biotechnology and genetics to enhance crops, make our foods safer, develop new medicines, and protect the environment.

Payoff

- **Put the farm in farmaceutical.** Farm fields are becoming the new, cost-efficient factories for medicine production. Phytomedics, a spin-off biopharmaceutical company at **Rutgers,** is developing pharmaceuticals for rheumatoid arthritis and type II diabetes. Selected New Jersey growers are already raising plants with the special properties, which economists estimate could increase New Jersey farm income by $30 million. **Arkansas** scientists engineered *Brassica carinata*, an oilseed mustard, to produce two human proteins that are expected to regulate cancer's spread. **North Carolina State** researchers are developing a cost-effective way to produce a vaccine that would protect people against viruses that cause cervical and certain skin cancers.

- **Eat, eat. It's good for you.** Reduced-calorie fat substitutes designed by **Georgia** researchers contain fish oil and fatty acids known to lower blood cholesterol levels by half and boost immune response by increasing T-cells by 19 percent. **Florida** researchers discovered the genetic pathways to folate production in tomatoes. This could lead to crops rich in the birth defect-preventing nutrient especially important to the developing world. **Purdue** scientists developed strains of tomatoes with higher levels of lycopene, an antioxidant known to reduce various cancers, cardiovascular disease, and macular degeneration. **Purdue** scientists also are studying wheat genes to add beta glucan, a substance in oat and barley that lowers cholesterol and reduces human insulin need. **Texas A&M's** Vegetable and Fruit Improvement Center has successfully added flavonoids, carotenoids, and antioxidants – compounds that prevent heart disease, stroke, and some forms of cancer – to carrots, peppers, and melons. In conjunction with **Oklahoma State, Texas A&M**

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also developed peanuts that contain more oleic acid, a healthful nonsaturated fat that lowers bad cholesterol and raises good cholesterol.

- **Look it up.** Gene libraries speed the use of new technologies to benefit farmers and consumers. For example, the Wheat Genetics Resource Center at **Kansas State** holds 2,500 wheat species accessions and 2,200 cytogenetic stocks, considered genetic treasures to wheat scientists around the world. **Delaware's** poultry database GenBank lets poultry breeders optimize vaccine efficacy and improve other characteristics. Clones are distributed worldwide to researchers.

- **Resistance is not futile**. The disease Sudden Death Syndrome (SDS) is the grim reaper for soybean fields. **Tennessee** researchers developed a new SDS-resistant soybean variety with excellent yields that is adapted to millions of acres throughout the Mid-South and Southeast. It's also resistant to stem canker and frogeye leaf spot and will serve as parent stock for future varieties. **Ohio State** researchers discovered genes with partial and full resistance to phytopthora root rot, a disease that costs Ohio growers $120 million in bad years. **North Carolina State** researchers discovered genes that could be harnessed to develop soybean and tobacco varieties that resist cyst nematode damage. This discovery will help fight soybean cyst nematode – which causes up to $20 million in damage in North Carolina alone – and the newer tobacco cyst nematode. **Alaska** scientists are studying genes that produce osmotin, a plant defense protein, to improve disease resistance and cold tolerance in the state's important potato crop.

- **Good for the grower.** Land-grants and the USDA help farmers address basic production problems through biotechnology. **Purdue** scientists discovered that fat cells regulate how pigs handle stress and disease, which can keep pigs from attaining full growth. Now scientists can target fat cells via genetic selection or use new drugs to keep pigs happy and productive.

- **Easy on the environment.** Dicamba herbicide, widely used to control broadleaf weeds in grassy crops but off-limits to soybeans and cotton, is economical and environmentally friendly. **Nebraska** researchers discovered how to genetically modify broadleaf crops to tolerate dicamba. Researchers are now working on dicamba-resistant soybeans and plan to create resistant canola and cotton. **Maryland** researchers have discovered infection-specific plant genes that may lead to the development of the next *Bacillus thuringiensis* (Bt) toxin and add to the collection of economical, environmentally friendly tools for controlling insect pests.

- **What will the neighbors think?** Consumer acceptance of biotechnology will be key in how broadly the science is adapted. **Nebraska** research shows acceptance depends on whether consumers think the technology benefits them and whether they believe foods made from genetically modified crops differ from traditional products. Findings provide a clearer picture of what's likely to happen to biotech products in the marketplace. **Prairie View A&M** discovered most minorities were unsure of the technology and, with other 1890 land-grant universities, worked to establish the Southern Agbiotech Consortium for Underserved Communities. The consortium educates teachers, parents, and students – school-aged to university – about biotechnology. Research at **South Dakota State** showed a minority of people felt the technology should not be adopted, less than one-third of those surveyed had some level of discomfort, and two-thirds supported biotechnology. **Arkansas,** with **Tennessee State, North Carolina A&T,** and **Arkansas-Pine Bluff**, is measuring social acceptance of food biotechnology, including herbicide-tolerant rice varieties, important in the fight against damaging red rice.

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